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BIOLOGICAL EVALUATION
Douglas-fir Tussock Moth in the Southwest

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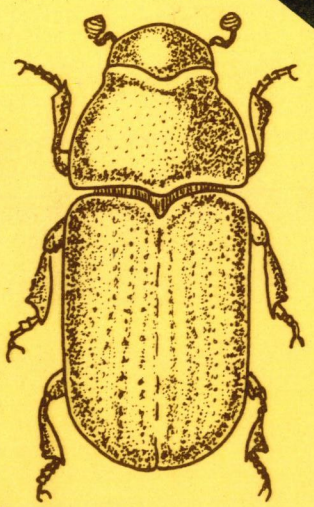

Southwestern Region

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BIOLOGICAL EVALUATION
Douglas-fir Tussock Moth
in the Southwest

1978

Forest Insect and Disease Management
State and Private Forestry
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INTRODUCTION

The Douglas-fir tussock moth, Orgyia pseudotsugata McD., is a major defoliator of Douglas-fir, Pseudotsuga menziesii var. glauca (Beissen.) Franco, and true firs, Abies spp., in North America. The tussock moth completes one generation each year. It overwinters in the egg stage and larval emergence occurs in late May or early June depending on temperature and location. Larvae feed first on new needles and later on older foliage as they mature. Pupation occurs in the foliage during August. Adults emerge in late August and eggs are deposited in a single mass on the cocoon of the wingless female.

Natural populations of the tussock moth are cyclic. In the Pacific Northwest outbreaks usually develop explosively into epidemic levels within the first year, followed by a dramatic decrease the third year of the infestation. Infestations in the Southwest do not appear to follow the typical pattern observed in the Pacific Northwest. The first reported outbreak in the Southwest was discovered in 1957 on the Pinal Mountains, Tonto National Forest, Arizona. Within a year, three new infestations were detected: Baker Mountains, Tonto National Forest; Capitan Mountains, Lincoln National Forest; and Sandia Mountains, Cibola National Forest (Yasinski 1960). These outbreaks persisted from 1957 to 1960, when the areas were treated with DDT. Natural populations recurred again at epidemic levels in these same areas from 1967 to 1970 (Lessard 1975).

In 1966, the tussock moth was first recorded on ornamental fir and spruce trees in the Southwest in the northeast section of Santa Fe, New Mexico. Infestations were detected in 1968 on ornamental trees in Los Alamos and Ruidoso, New Mexico. The infestations in these cities have persisted at low to moderate levels since being detected and do not appear to be cyclic, as is the case for natural populations (Lessard 1975).

Natural populations of the tussock moth again appeared in 1975 in Trigo Canyon on the west side of the Manzano Mountains, Cibola National Forest. Since 1975, several geographically distinct infestations have been detected and are causing noticeable defoliation with some scattered tree mortality. Assessment of tussock moth populations in 1978 suggests that the tussock moth will continue on the upsurge in the Southwestern Region.

TECHNICAL INFORMATION

Insect.--Douglas-fir tussock moth, Orgyia pseudotsugata McD.

Hosts.--White fir, Abies concolor (Gord. & Glend.) Lindl.
Douglas-fir, Pseudotsuga menziesii var. glauca (Beissen.) Franco
Ornamental blue spruce, Picea pungens Engelm.

Type of Damage.--Douglas-fir tussock moth larvae damage host trees by feeding on the foliage. Newly hatched larvae feed on the new foliage causing it to shrivel and turn brown. Later, third stage and larger larvae feed on both old and new foliage. They first strip needles from the tops of trees and outermost portions of the branches; then they feed lower in the crown and farther back on the branches. Defoliation by the tussock moth greatly retards tree growth, can kill and top-kill trees, and weaken trees to the point where they can be killed by other insects.

METHODS

During the month of September 1978, 12,000 acres of forested land on the Cibola and Santa Fe National Forests, and adjacent lands, were surveyed for Douglas-fir tussock moth. Each infestation was surveyed for defoliation, egg mass densities, tree damage, and to delineate the boundaries of the outbreak. Defoliation was estimated visually from the ground. Hosts trees were checked for the presence of egg masses and cocoons. To determine the incidence of natural virus in the population, 20 egg masses from each area were sent to the Forestry Sciences Laboratory at Corvallis, Oregon, but results will not be available until early 1979.

RESULTS AND DISCUSSION

In 1978, the tussock moth defoliated 7,000 acres of forested land, a three fold increase from 1977 (Table 1). Eight separate infestations ranged in size from 300 to 2,500 acres, and in age from 1 to 4 years.

Table 1. Douglas-fir tussock moth defoliation in New Mexico.

Location	Acres	
	1977	1978
Santa Fe National Forest*		
Cochiti Canyon	100	400
Medio Dia Canyon	500	1,200
Nambe Canyon	300	800
Los Alamos	1,000	2,500
Cibola National Forest*		
Bear Canyon	---	1,000
Canyon del Agua	200	300
Domingo Baca Canyon	100	200
Trigo Canyon	300	600
	2,500	7,000

*Acres of infestation on lands adjoining the National Forests are included in the figures shown above.

All infestations occurred in mixed conifer type in steep-sided drainages. In each outbreak, the tussock moth is causing top-kill and tree mortality to Douglas-fir and white fir. The following section discusses each outbreak in detail.

Cibola National Forest and Adjacent Private Land

Bear Canyon. This outbreak is located 15 miles northeast of Albuquerque within the boundaries of the Ellena Gallegos Grant, on the west side of the Sandia Mountains. The canyon is situated west to east, terminating at the base of the mountain crest, with elevation ranging from 7,000 to 8,500 feet. Access to the canyon is by footpath. The tussock moth was first detected in 1978 causing heavy defoliation on 1,000 acres (Fig. 1 and 2). High egg mass densities throughout the infested area were found during the fall survey. Tussock moth population levels will continue to increase in 1979, with a subsequent increase in the amount of defoliation. Tree mortality is expected to be above 50 percent with 2 years of complete defoliation and near 100 percent after 3 years.

The canyon is composed of mixed conifer type with a large proportion of host trees. The infestation should spread throughout the canyon causing severe tree losses. The east side of the Sandia Mountains is primarily white fir and Douglas-fir, and the Bear Canyon outbreak has the potential to spread to this area.

Canyon del Agua. The infestation is located 20 miles northeast of Albuquerque on the west side of the Sandia Mountains. The canyon is situated west to east, terminating at the base of the mountain crest, with elevation ranging from 7,000 to 8,500 feet. Access to the canyon is by footpath only. The tussock moth has been defoliating scattered trees in the canyon for 4 years. The infestation has spread to the upper slopes of the canyon in 1978, causing 300 acres of heavy defoliation. Tree mortality on the lower slopes and canyon bottom is 100 percent of the host-type. Although tree mortality will continue to increase in 1979, the dominant type, pinyon-juniper, surrounding the infestation will limit the severity of the outbreak.

Domingo Baca Canyon. The infestation is located 15 miles northeast of Albuquerque on the west side of the Sandia Mountains, directly below the aerial tramway. The canyon is situated west to east, terminating at the base of the mountain crest, with elevation ranging from 7,000 to 8,500 feet. There are no trails in this canyon; access is by following the main canyon arroyo. The infestation is causing defoliation of host-type, which occurs in the eastern portion of the canyon, and has been there for 3 years. The tussock moth will continue to cause heavy defoliation and tree mortality in 1979. Since the forest type surrounding the canyon is pinyon-juniper, spread is limited to the host-type within the canyon.

Figure 1. Defoliation during the first year of the outbreak in Bear Canyon, Ellena Gallegos Grant, 1978.

Figure 2. Douglas-fir, white fir and ponderosa pine defoliated in Bear Canyon, Ellena Gallegos Grant, 1978.

Trigo Canyon. This outbreak is located 40 miles southeast of Albuquerque on the west side of the Manzano Mountains. The canyon is situated west to east, terminating at the mountain crest, with elevation ranging from 7,000 to 9,500 feet. Access to the canyon is by footpath. The tussock moth has been present for at least 4 years, causing severe defoliation and tree mortality. In 1978, the tussock moth continued to defoliate the remaining host species on the upper slopes of the canyon. Tree mortality has been so extensive that all host species on the lower to mid-slopes of the canyon have been killed. Severe defoliation and tree mortality will continue in 1979. This outbreak should be closely monitored in 1979.

Santa Fe National Forest and Adjoining Land of Mixed Ownership

Cochiti Canyon. This outbreak is located 70 miles northwest of Albuquerque, adjacent to Medio Dia Canyon. The canyon is situated south to north, with elevation ranging from 6,500 to 7,200 feet. The canyon is accessible for its entire length by a forest road. Defoliation was light to moderate in 1977, increasing to moderate to heavy in 1978. High egg mass densities will cause heavy to complete defoliation and scattered tree mortality in 1979. Host-type extends for several miles to the north, and spread up the canyon will occur causing severe tree mortality over the next 2 to 3 years.

Medio Dia Canyon. The infestation is located 70 miles northwest of Albuquerque and 10 miles north of Cochiti Lake. The canyon is situated southeast to northwest, with elevation ranging from 6,500 to 7,000 feet. The canyon is accessible for 2 miles by a logging road and from the road termination by footpath. The infestation extends from the junction of Medio Dia and Cochiti Canyons to the intersection of Medio Dia and Del Norte Canyons (approximately 5 miles). Defoliation has been evident for 4 years, with severe tree mortality increasing in the past 2 years. Tree mortality is 100 percent in the southern end of the canyon and mortality will continue to increase throughout the canyon as the infestation progresses. The population will contine to spread northwest as the type extends in this direction for several miles.

Nambe Canyon. The outbreak is located 20 miles north of Santa Fe on the boundary of the Nambe Indian Reservation and the Santa Fe National Forest. The canyon is situated west to east, with elevation ranging from 6,500 to 9,500 feet. The canyon is accessible by footpath only. The tussock moth has caused defoliation and scattered tree mortality for the past 3 years. The infestation encompasses 800 acres and will increase in size and severity in 1979. The infestation will continue to spread eastward toward the Pecos Wilderness, which includes thousands of acres of host-type.

Los Alamos and Pueblo Canyons. These infestation centers are located within the townsite of Los Alamos and nearby lands in Los Alamos County and on National Forest land. These canyons are situated east to west, with elevation ranging from 7,400 to 8,000 feet. Los Alamos Canyon is accessible by improved road and Pueblo Canyon is accessible by footpath. The infestations in these canyons have been causing light to moderate defoliation since 1968. The intensity of the outbreak increased from 1975 to 1978, causing heavy defoliation and tree mortality. Areas surrounding the bridges over Los Alamos and Pueblo Canyons have 100 percent tree mortality (Fig. 3). In 1978, a pilot project was conducted using nucleopolyhedrosis virus. The virus was aerially applied to 1,300 acres (526 ha) located within Los Alamos and Pueblo Canyons. Over 1,900 ornamental trees were treated with a ground application of carbaryl. Suppression exceeded 95 percent larval mortality. However, the infestation is expected to continue in the Los Alamos area as several pockets of defoliation remain outside the treatment area.

Figure 3. Douglas-fir and white fir mortality in Pueblo Canyon, Los Alamos, New Mexico, 1978.

OUTBREAK TREND

Survey results indicate an increase in intensity and severity of tussock moth outbreaks for 1979. Several canyon infestations have the potential

to spread into large host-type acreages. All the infestations could sustain heavy tree mortality over the next 3 to 4 years. The tussock moth is a cyclic insect. In New Mexico, infestations are known to persist up to 10 years. If this pattern holds true, plans should be made at present to insure maximum protection to valuable resources.

The forested canyons affected by this defoliator, especially Bear, Cochiti, and Medio Dia Canyons, are high-use recreational areas. The defoliation and mortality will be aesthetically displeasing and recreational values will be adversely affected. Visitor use of picnic sites, campgrounds and trails could be curtailed by the infestation.

ALTERNATIVES

Several alternative strategies are available to the land manager to deal with DFTM infestations. Effectiveness, environmental acceptibility, and economical feasibility become primary criteria for selection of an alternative. The alternatives, their advantages and disadvantages, follow:

1. No Action

The outbreak would be allowed to run its course until brought under control by natural means such as virus, parasites, predators, and/or weather.

The advantage to this alternative is that there would be no pesticide application. In addition, temporary increases in water yield and game forage, resulting from the reduction of forest cover, could result from this alternative.

Disadvantages to no action are loss of trees, cost of reforestation, increased fire hazard, and adverse effects on aesthetic and recreation values. Some canyons have trails, camping, and/or picnic areas which would become undesirable if the forest cover were removed by defoliation. Dead trees and dead tops would have to be removed to reduce hazards to users, thus increasing maintenance costs. Tree losses will approach 100 percent in areas defoliated 3 to 4 years.

2. Direct Suppression

Delivery of pesticides to the target organisms can be accomplished by ground or aerial application. Ground application involves the use of hydraulic sprayers, mist blowers, etc., and is used in easily accessible areas with trees in the 10- to 50-foot height range. Aerial application involves the use of fixed- or rotary-wing aircraft, and is primarily used on larger, less accessible acreages due to economy.

a. Chemicals would provide larval suppression in the early stages, thus insuring protection of existing foliage. Carbaryl (Sevin R -4-oil and Sevimol R-4) and Dibrom R are currently registered with the Environmental Protection Agency. Sevin R -4-oil is registered for aerial use. Sevimol R -4 and Dibrom R are registered for ground application.

Disadvantages to the use of chemical insecticides are adverse effects caused by deposit in streams, soil, vegetation, litter, or an increase in the residue levels in fish, wildlife, or domestic animals.

b. Microbial insecticides would provide control with no adverse environmental effects. Currently, the nucleopolyhedrosis virus (NPV) and several formulations of Bacillus thuringiensis (B.t.) are registered by the Environmental Protection Agency for use against the tussock moth.

The disadvantages to using microbial agents are the need for exact biological timing of application to insure maximum effectiveness, a slower mortality rate resulting in additional foliage loss, and a more climate-sensitive material with shorter residual activity which could reduce effectiveness. Generally, microbial insecticides provide long-term population reduction, while sacrificing immediate suppression and foliage protection.

RECOMMENDATIONS

The results of the egg mass and defoliation surveys indicate an increase in population densities and subsequent defoliation in 1979. If no action is initiated, heavy defoliation will cause top-kill and tree mortality. A suppression project is recommended in the spring of 1979 if forest values and uses must be maintained. Otherwise, the "do nothing" alternative is recommended.

Aerial application would be the most feasible method for treating Bear and Medio Dia Canyons because these areas are not accessible by road. Cochiti Canyon is accessible by road and could be treated aerially or from the ground due to the small acreage and the close proximity of the infestation to the road. Carbaryl is recommended because of the relatively low cost of application. However, the NPV is recommended where environmental acceptibility is of concern.

LITERATURE CITED

Lessard, E. D. 1975. The occurrence and control of the Douglas-fir tussock moth in the Southwestern Region. USDA Forest Service. R-3 76-14. 5 pp.

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